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The Indiana Water Resource

Availability, Uses, and Needs

GOVERNOR'S
WATER RESOURCE STUDY COMMISSION,
STATE OF INDIANA

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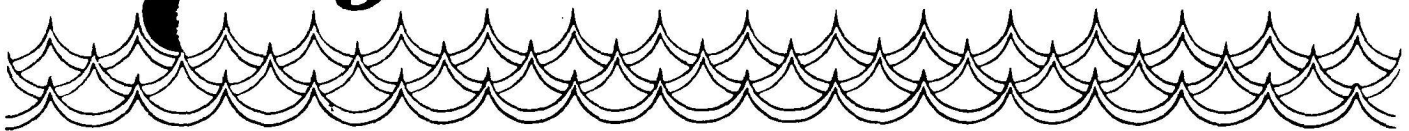
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Region One-A



Lake and Porter Counties, located in the extreme northwest corner of Indiana, form Region One-A. The region contains approximately 939 square miles and is bounded by Lake Michigan to the north, the Porter-LaPorte county line to the east, the Kankakee River to the south, and the Indiana-Illinois state line to the west, as shown in Figure 51.

The population of Region One-A in 1975 was 643,084, of which eighty-five percent resided in Lake County. The official Indiana projections for 1975 to the year 2000 indicate that the region's population may increase by nineteen percent. The major population growth is expected to occur in Porter County. The projections for each county follow.

Table 29

The 1975 and projected populations for Region One-A.

County	1975	1980	1990	2000
Lake	546,757	559,100	578,800	585,700
Porter	96,327	107,800	140,700	181,300
Totals	643,084	666,900	719,500	767,000

The major population centers within the region are Hammond, Gary, and East Chicago in Lake County, and Valparaiso and Portage in Porter County. These urban centers accounted for fifty-six percent of the region's 1975 population.

One of the world's largest industrial and commercial complexes is located within the region along the shoreline of Lake Michigan. The lake provides a plentiful supply of water and invaluable transportation for this industrial complex.

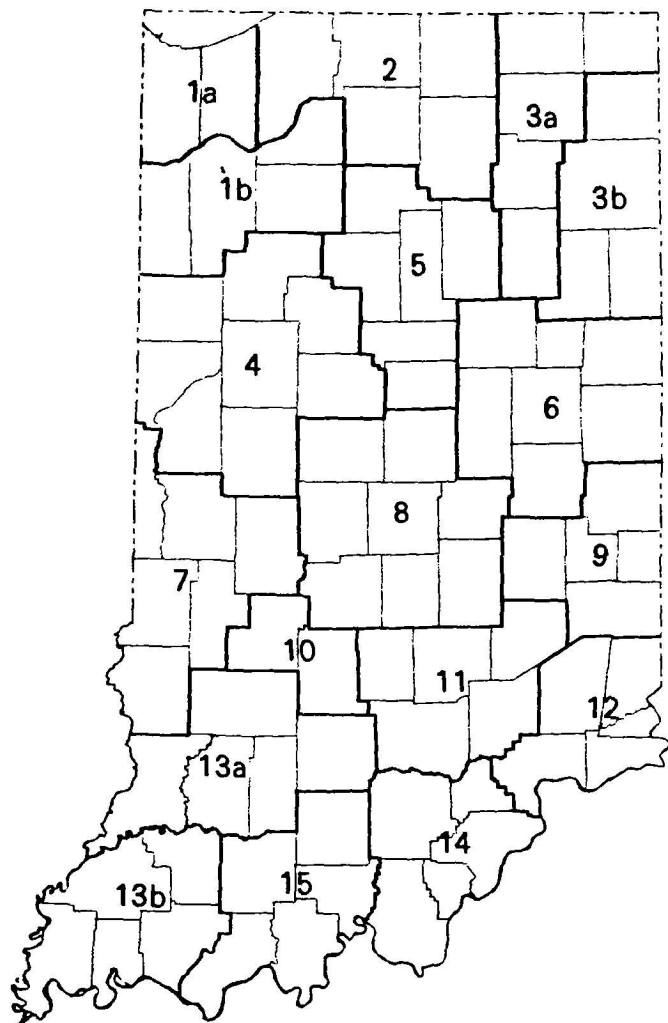


Figure 51

Map of Indiana showing the location of Region One-A.

More than seventy percent of the region's work force was employed within Lake County during 1975. Manufacturing provides approximately forty-seven percent of the total employment while wholesale and retail enterprises provide approximately twenty-two percent.

Agriculture is the dominant land use within the region with more than sixty-seven percent of the area devoted to this purpose. Approximately seven percent of land is forested while the remaining twenty-six percent is urban and miscellaneous land uses.

The region is generally characterized by flat to gently rolling topography, with the exception of the sand dunes associated with the current shoreline of Lake Michigan. The dominant land form is the Valparaiso Moraine which forms the major drainage divide within the region. Streams located north of the moraine flow toward Lake Michigan, while those located south flow into the Kankakee River.

The climate of the region is directly influenced by Lake Michigan. Such influence is most pronounced just inland from the shore of the lake and diminishes rapidly with distance. Cold air passing over the warmer lake water produces precipitation leeward of Lake Michigan in the fall and winter. In the spring, daily maximum temperatures are lower near the lake because of the cooling effect of the lake. Average minimum temperatures in the fall are higher in northwestern Indiana than those further to the south.

Average annual precipitation in the region is approximately 36.0 inches with average monthly values ranging from a high of 4.0 inches in April to a low of 1.5 inches in February. Of the 36.0 inches of average annual precipitation approximately 26.0 inches are consumed through evapotranspiration while approximately 10.0 inches appear as streamflow. The region has average temperatures ranging from 24°F. in January to 73°F. in July. The average annual temperature is 50°F. Data from the nearest recording weather station, Chicago Midway Airport, indicates the annual prevailing wind is from the west at 10.4 miles per hour.

THE WATER RESOURCE

Ground Water

The unconsolidated deposits located in Region One-A were formed by glacial action, wind, and shoreline processes associated with ancestral Lake Michigan. The thickness of these materials varies from less than 50 to over 300 feet; and the types of deposits present include lake clays, glacial till, dune sand, and outwash sand and gravel. Sand and gravel deposits serve as important aquifers in much of the area, particularly south of the Valparaiso Moraine. Fine sand

and lake clays, which predominate in areas near Lake Michigan, do not constitute a major ground-water source.

Beneath these materials are found bedrock formations of Silurian and Devonian ages. The youngest of these rocks is the black shale found beneath the unconsolidated deposits in nearly all of Porter County. In Lake County, Silurian and Devonian limestones and dolomites form the underlying bedrock and represent an important source of ground water, especially in the southern and western portions of the county.

The availability of ground water is associated with the nature and type of aquifer materials present in a given area. In this region, there is a pronounced variability in ground-water occurrence from north to south, as shown in Figure 52. In areas near Lake Michigan, well yields are generally less than 100 gallons-per-minute (gpm) and may be even lower in some localities. Shallow, fine sand is the primary aquifer source in these areas and does not yield water readily. Beneath the sand are found either fine grained lake clays or glacial till deposits which do not yield water. Further south, well yields improve appreciably where outwash sand and gravel deposits occur that are capable of producing 200 to 600 gpm. These deposits are associated with the Kankakee River valley and are thickest in eastern Porter County. In addition, higher well yields are also obtainable in southwestern Lake County from the Silurian limestone-dolomite aquifer, although hydrogen sulfide may be encountered in some instances.

Ground water within the region is generally hard (300 to 500 parts-per-million), although ground water in the southern and eastern portions of the region is softer (90 to 210 parts-per-million).

Surface Water

Streamflow The majority of streams in Lake and Porter Counties have their origins within the two counties and do not have large drainage areas. These streams have their headwaters near the center of the counties on the low ridges that parallel the Lake Michigan shoreline. They either flow south into the Kankakee River or northward into the Little Calumet River and Lake Michigan. The only streams of consequence originating outside the two counties are Plum Creek which originates in Will County, Illinois, and the Little Calumet River which has its source in LaPorte County.

The Calumet River system has a long history of modifications, flow reversals and diversions into and out of the river. The river is known as the Grand Calumet or the Little Calumet. The Little Calumet River in Indiana is divided into the east and west arms. About seven miles of the west arm has been replaced

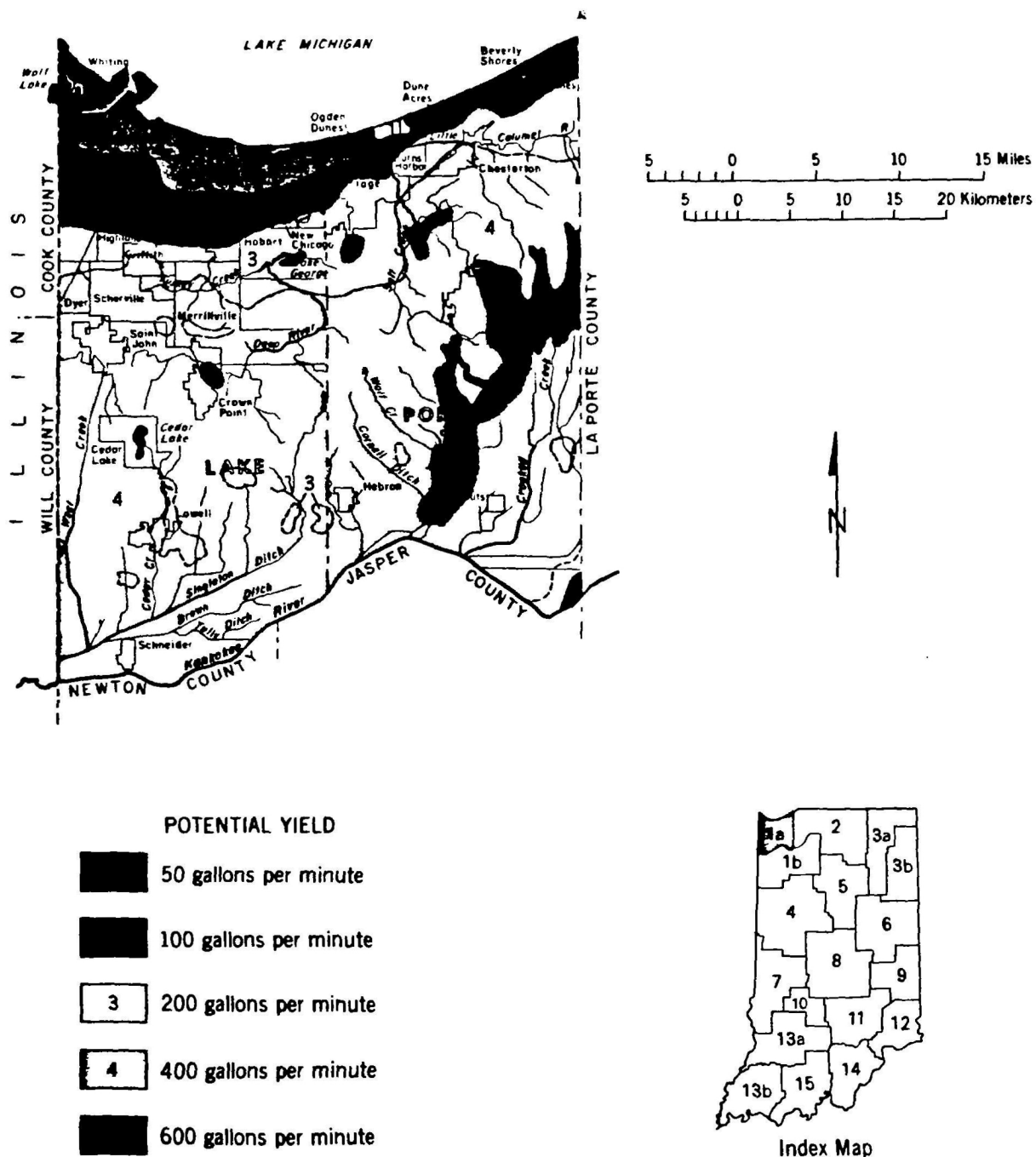


Figure 52
Map of Region One-A showing the general location and potential yield of ground water from properly constructed large diameter wells.

by Burns Ditch. Burns Waterway furnishes the outlet into Lake Michigan for the east arm of the Little Calumet River, Deep River, and all of the west arm of the Little Calumet River east of Griffith. From Griffith westwardly, the Little Calumet flows into Illinois and eventually into the Illinois River. The Grand Calumet

River discharges its limited flows into Lake Michigan by way of the Indiana Harbor Canal.

The seven day, once in ten year (Q7-10); one day, once in thirty year (Q1-30); and the average annual flow in million-gallons-per-day for streams with gaging stations within Region One-A are presented below.

Table 30
Flow characteristics of streams.

Stream	Drainage Area (square miles)	Million-Gallons-Per-Day		
		Average Annual	Q7-10	Q1-30
Deep River below Lake George in Hobart	124	60	3.3	2.5
East Arm Little Calumet River at Porter	66	46	13.0	11.0
Kankakee River at Dunns Bridge	1,352	825	210.0	180.0
Kankakee River at Shelby	1,779	1,010	270.0	220.0
West Arm Little Calumet River at Munster (Flows into Illinois)	90	43	2.1	1.3

The low-flow characteristics indicate that the largest and most reliable streamflow is that of the Kankakee River. The Kankakee has a sustained flow of at least 220 million-gallons-per-day (mgd), and its average annual flow exceeds 1,000 mgd. The flow duration curve for the Kankakee River at Shelby, as shown by Figure 53, indicates the stream will have a dependable flow of at least 400 mgd ninety percent of the time.

The slope of the flow duration curve indicates that the Kankakee River basin contains aquifers which provide significant ground-water contribution to

streamflow. To verify this, the technique of hydrograph separation was applied to three annual hydrographs representing "dry," "average," and "wet" years. The results indicate that the ground-water contribution to streamflow amounts to seventy-two, sixty-four, and thirty-two percent for "dry," "average," and "wet" years, respectively. Conversely, from twenty-eight to sixty-eight percent of the flow, depending on the year, is due to direct surface runoff from runoff-producing precipitation events or from snowmelt.

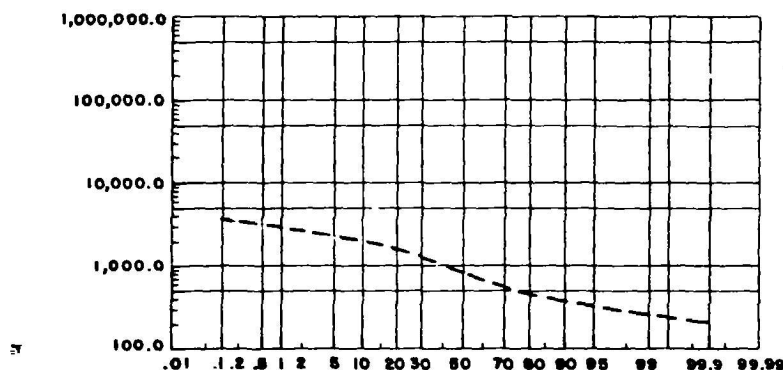


Figure 53
The flow duration curve for the Kankakee River at Shelby.

Lakes Lake Michigan is the dominant water feature within the region, and is the major source of industrial and public water supplies. Approximately 154,000 acres of Lake Michigan are included within Indiana.

The remaining fourteen lakes within the region that are at least 50 acres in size or have a storage capacity

of 32.5 million gallons or more, are presented in Table 31 and are located on Figure 54. These lakes have a combined surface area of approximately 2,770 acres with a gross storage capacity of approximately 4,900 million gallons.



Map of Region One-A showing the location of lakes that are at least 50.0 acres in size or with a storage capacity of 32.5 million gallons or more. Lake numbers correspond to the lake numbers in Table 31.

Table 31
Lakes at least 50 acres in size or with a storage capacity of 32.5 million gallons or more.

Lake Number	Lake Name	Drainage Area (square miles)	Surface Area (acres)	Gross Storage (million gallons)
1	Cedar Lake	8.14	781.0	2,199
2	Dalecarlia Lake	20.10	193.0	na
3	Lake George at Hobart	124.00	282.0	879
4	Wolf Lake	5.72	999.0	na
5	Lake George at Hammond	na	78.0	na
6	Flint Lake	2.62	86.0	na
7	Lake of the Four Seasons Nos. A and B	na	na	133
8	Lake of the Four Seasons No. C	na	na	553
9	Lake Louise	2.56	228.0	645
10	Lake of the Woods	na	24.5	65
11	Long Lake	1.31	65.0	169
12	Norman Olson Lake	0.23	14.0	38
13	Rice Lake	na	38.3	58
14	Spectacle Lake	0.53	62.0	175

na: not available.

UTILIZATION OF THE WATER RESOURCE

Instream Uses

The supply and demand analysis for recreational uses of water by the residents of Region One-A is presented in Table 32. The existing supply for recreational activity is expressed as a percentage of the projected demand. Therefore, when this percentage exceeds one hundred the supply exceeds the demand. Conversely, when the existing supply as a percentage of demand is less than one hundred percent, the supply is less than the projected demand.

Boating and Waterskiing Both Lake and Porter Counties have rivers available for boating and waterskiing. Deep River in Lake County is used for waterskiing. Waterskiing on the Kankakee River is dangerous due to occasional debris in the water. Boating is allowed on other streams, including the Little Calumet River. Lake Michigan is used extensively for boating and some waterskiing. Dangerous conditions can come up quickly on this lake; therefore, boating on Lake Michigan is limited to craft larger than sixteen feet during favorable conditions. Cedar and Wolf Lakes also provide waterskiing in Lake County. Porter County has only Lake Michigan suitable for waterskiing, although boating is allowed on most other lakes.

Table 32
The outdoor recreation demand and supply analysis.

Activity	Percent of Population Participating	Density Guideline	Approximate Supply	Existing Supply as a Percentage of Projected Demand		
				1980	1990	2000
Boating	27	19.6 boats/acre/year	157,000 acres ^a	100+	100+	100+
Waterskiing	7	34.4 skiers/acre/year	19,200 acres ^b	100+	100+	100+
Canoeing	10	585 canoes/mile/year	97 miles	100+	100+	93+
Swimming	57	76,600 swimmers/acre/year	105 acres ^c	100+	100+	100+
Ice-Skating	12	6,678 skaters/acre/year	45 acres	100+	100+	100+
Fishing	43	66 persons/acre/year	161,400 acres ^d	100+	100+	100+

This table is based upon the 1979 Indiana State Outdoor Recreation Plan. Only the supply and recreational demands of residents of the region are displayed. The available recreational opportunities outside the region are not considered, nor are the recreational demands of nonresidents considered.

^aIncludes 154,000 acres of Lake Michigan and 3,000 acres of inland waters.

^bIncludes 18,400 acres of Lake Michigan (thirty square miles excluding the two hundred feet from the shoreline) and 800 acres of inland waters.

^cDoes not include Lake Michigan.

^dIncludes 154,000 acres of Lake Michigan and 7,400 acres of inland waters.

Cedar Lake, Flint Lake, Wolf Lake, and Lake Michigan have some form of public access. Access to the Kankakee River is available at the LaSalle Fish and Wildlife Area in Lake County. Access to other rivers is limited by the lack of boat ramps and parking facilities. Due to the recreational potential of Lake Michigan, no shortage of boating and waterskiing areas is projected to occur in Region One-A. However, access to Lake Michigan is limited by a shortage of boat storage and launching opportunities.

Canoeing Canoeing opportunities in the region are numerous. Eleven miles along Deep River in Lake County is canoeable. A ten mile trip is available on the East Branch of the Little Calumet River. The Kankakee River along the southern border of the region is an excellent canoeing stream.

The region does not have a current need for additional canoeing stream mileage. However, the demand is expected to increase by the year 2000 when a shortage of canoeing opportunities may occur.

Swimming and Ice-Skating Swimming is available in Lake Michigan at municipal beaches, the Indiana Dunes State Park, and the Indiana Dunes National Lakeshore. In addition swimming is available on inland lakes and numerous public pools. Ice-skating is available on the smaller lakes within the region, but is not available on Lake Michigan due to safety considerations. The demand and supply analysis indicates that the supply of swimming and ice-skating areas will exceed the demand generated by residents of Region One-A through the year 2000.

Fishing The quality of the fisheries habitat is indicated on Figure 55. Many of the lower reaches of the streams in southern Lake and Porter Counties have been straightened and dredged to provide agricultural drainage. The Kankakee River serves as the main outlet of this southern drainage, and although it has been extensively channelized, provides good aquatic habitat. It flows steadily with sufficient depth to provide food and cover for warmwater fishes such as bluegill, crappie, largemouth and smallmouth bass, other sunfishes, catfish, and suckers. Northern pike and walleye are also present, using tributaries and flooded woods and backwaters for spawning in the spring. Crooked Creek contains suitable aquatic habitat and water quality to support a "put-and-take" trout fishery. With these exceptions, most southern streams offer limited aquatic habitat due to their channelized bed, lack of aquatic plants, and overall lack of diversity.

In general, streams have been channelized less in the northern portion of the region, but aquatic habitat

suitable for game fish is limited in some streams by poor water quality. The West Arms of the Little Calumet and the Grand Calumet Rivers offer poor aquatic habitat due to heavy input from industrial and domestic pollution sources. They may support only rough fish populations including carp and white suckers. In contrast, Salt Creek and the East Arm of the Little Calumet River are used by Lake Michigan trout and salmon for spawning. Salt Creek also provides habitat for a put-and-take trout fishery.

The region has fewer lakes than the other parts of northern Indiana, and intense shoreline development is characteristic of most of its lakes. Moderately good aquatic habitat can be found in most lakes in the region as is indicated by the presence of thriving game fish populations. Lake Michigan provides an abundance of fishing water and is especially noted for coho and chinook salmon; steelhead, lake, and brown trout; and yellow perch. Fancher Lake is stocked with trout, besides supporting a warmwater fishery. Wolf Lake is noted for largemouth bass, bluegill, and northern pike fishing. Another example of good aquatic habitat is Flint Lake, evidenced by its bluegill, black crappie, and largemouth bass fishing. In comparison, Cedar Lake provides spawning areas in the wetlands along its south end, but desirable game fish populations are limited by poor water quality.

Fishing access to streams and lakes can usually be found at bridges or city and county parks. Almost two-thirds of the lakes have public access for fishing. A state-owned public fishing site is located on Cedar Lake. Lake Michigan offers beach and pier fishing at municipal parks, the Indiana Dunes State Park, the Indiana Dunes National Lakeshore, and fishing from boats.

Lake Michigan and an additional 3,000 acres of inland waters insure that the demand for fishing through the year 2000 will be met. Use of Lake Michigan is limited, however, by the frequent occurrence of rough water and by inadequate public access.

Riparian Habitat The quality of the wildlife habitat associated with surface streams is indicated in Figure 56. The streams and lakes of the region differ greatly in the quality of habitat associated with their banks. The Kankakee River offers some of the most valuable riparian and wetland habitats, attracting furbearers, waterfowl, and other mammals such as deer and squirrels. The most outstanding wetlands of the region are the backwaters and wooded swamps along the lower portion of the Kankakee River. The LaSalle Fish and Wildlife Area located adjacent to the Kankakee River increases the wildlife production with the intensive management practiced on the property. Salt Creek and Crooked Creek also offer good wildlife habitat. Their

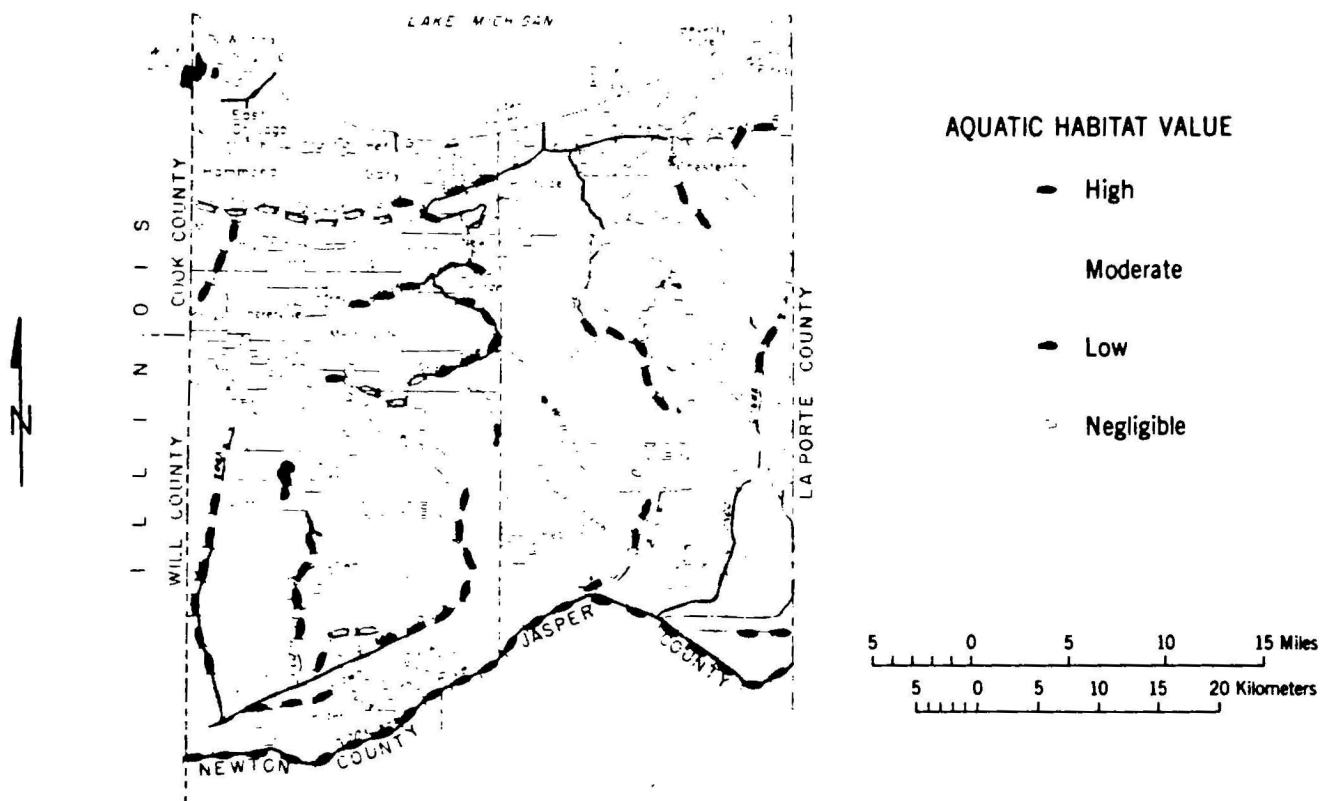


Figure 55
Map of Region One-A showing the quality of fisheries habitat.

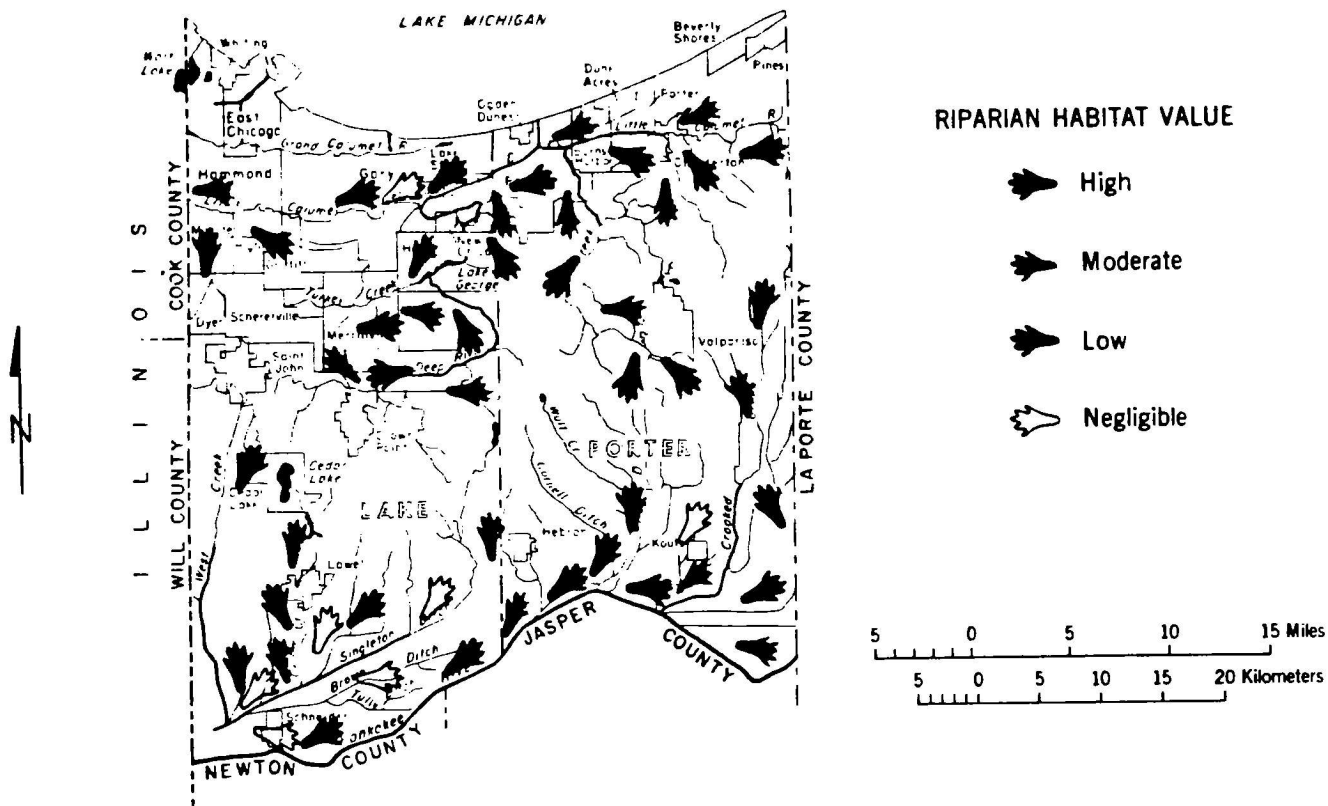


Figure 56
Map of Region One-A showing the quality of riparian habitat.

banks have a sufficient amount and diversity of vegetation to provide food and cover for many species of animals. Some of the straightened streams, such as parts of the Singleton Ditch and West Creek in Lake County, offer very poor riparian habitat. If their banks are grass covered, however, they will attract game birds such as pheasants and bobwhite quail. Other animals use them as nesting areas or travel lanes. The streams in northern urban areas provide small mammal and game bird habitat in the city and county parks. Large stretches of these streams, however, offer little wildlife habitat value.

Due to the heavy residential development along lakeshores in this region, only limited habitat is offered around lakes. Although many of the lakes have a small portion of their edges lined with a deep water marsh or open water wetland, others, most notably Cedar Lake, Lake George near Whiting, Lake George near Hobart, and Wolf Lake, have marshes large enough to provide significant habitat for muskrats, shorebirds, and various residential migratory waterfowl. The upland woods remaining around some lakes support small mammals such as squirrels, raccoons, opossums, songbirds, and larger mammals such as whitetail deer.

LaSalle Fish and Wildlife Area is the only facility allowing public hunting in the region. Access to private lands is through permission of the landowners.

Hydroelectric Power There are no hydroelectric generating stations now operating in Region One-A nor is there any site available where the combination of streamflow and available hydraulic head is sufficient for the economic production of hydroelectric power.

Commercial Navigation Lake Michigan is part of the Great Lakes-St. Lawrence navigation system, one of the most important inland waterway systems in the world. There are four commercial harbors in the region which provide access to this waterway. These are: Indiana Harbor, Gary Harbor, Buffington Harbor, and the Port of Indiana.

Traffic through these harbors consists of both inter-lake and overseas cargo. Harbor commerce consists of iron ore, petroleum, steel, grain, and general cargo.

Indiana Harbor was completed by the Corps of Engineers in the 1930s. Periodic dredging is necessary to maintain project depths. Gary and Buffington Harbors are private and are privately owned and maintained. The Port of Indiana (Burns Waterway Harbor) is owned and operated by the Indiana Port Commission, a state agency established for the purpose of developing and operating such facilities.

Withdrawal Uses

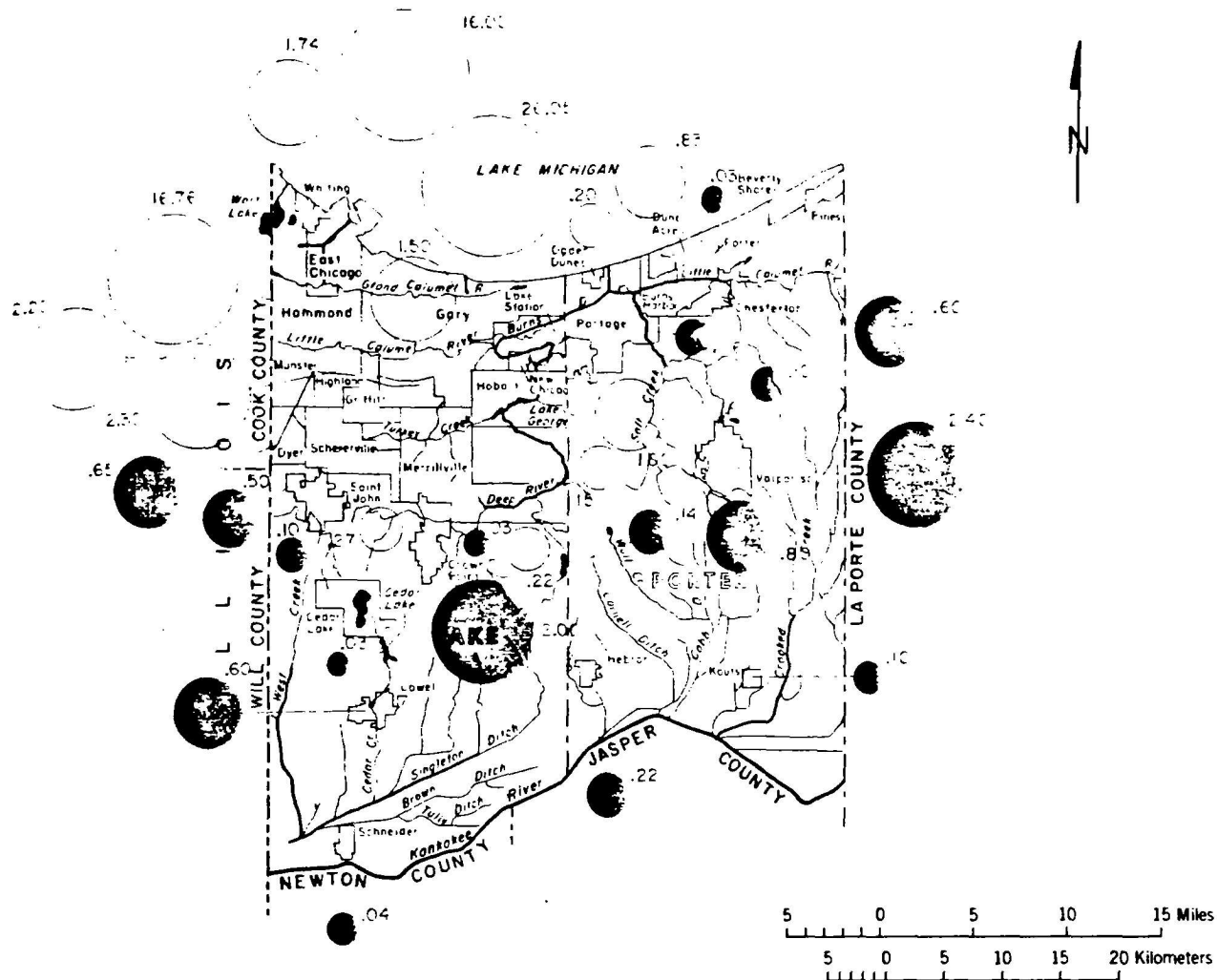
Public Water Supply Lake and Porter Counties are served by twenty-nine public water utilities. Eighty-nine percent of the population was served by a public utility in 1975. The utility systems in Lake County consist of several large utilities located along Lake Michigan, all withdrawing water from the lake. These utilities either serve or sell water to a "row" of towns just south of the lakefront communities. Further south, a third and sometimes a fourth "row" of communities had developed its own ground-water supply. South of Gary there are a few scattered urban areas, all with public water supplies dependent on ground water. Residents of Cedar Lake depend on private wells for a source of water. The service areas for public water utilities are shown in Figure 57.

The largest single water utility operating in the region is the Gary-Hobart Water Company which operates in both counties. This utility served about 248,600 persons in 1975. In 1977, it supplied an average of 29.1 million-gallons-per-day. Its direct distribution area includes all of the cities of Gary, Hobart, Portage, and Burns Harbor. In addition, the Gary-Hobart Water Company sells water to the cities of Lake Station, Schererville, Ogden Dunes, New Chicago, and Griffith for distribution through their lines. Two subdivision utilities, Lincoln and Turkey Creek, are also supplied by the Gary-Hobart Water Company. The Gary-Hobart Water Company withdraws all of its water from two intakes in Lake Michigan.

The city of Hammond also maintains an intake in Lake Michigan and in addition to serving all customers within the city limits, Hammond sells water to Munster, Highland, and the village of Lansing, Illinois.

Other large utilities in 1975 included the Hammond system which served 105,900 persons and withdrew 16.8 mgd, and the East Chicago system which served 44,200 and withdrew 16.0 mgd. Valparaiso, Highland, Munster, and Crown Point all pumped over 2.0 mgd in 1975. The towns of Whiting, Griffith, and Lake Station each withdrew between 1.0 and 2.0 mgd in 1975. Many of these systems, particularly those directly on the lake, serve industries that consume large amounts of water. The remaining systems to the south of the lakeshore primarily serve residential customers, withdrawing 0.6 mgd or less.

In 1975 these twenty-nine utilities withdrew an average of 77.3 mgd. Lake County accounted for 72.0 mgd while Porter County accounted for the remaining 5.3 mgd. About 67.0 mgd of the total public water supply is withdrawn from Lake Michigan, while 2.0 mgd is withdrawn from other surface water sources, principally Flint Lake. The remaining 8.4 mgd is withdrawn from ground-water sources.



EXPLANATION

Service area



Surface-water withdrawals



Ground-water withdrawals

.06 Mgd average daily use

Figure 57

Map of Region One-A showing the service areas of the public water utilities, and average daily use in million-gallons-per-day.

Because of the relatively good ground-water conditions in the southern three-fourths of the region, most communities relying on well supplies are able to develop well fields either within their community or within easy reach of their boundaries.

Projections of public water supply withdrawals indicate that water withdrawals by the region's public water supplies may increase to approximately 104 mgd by the year 2000. The 1977 and projected water withdrawals and consumption rates by public water utilities are presented below.

Table 33

The 1977 and projected withdrawal and consumption rates of public water supplies, in million-gallons-per-day.

<i>Public Water Supply</i>	<i>1977</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>
Withdrawal	77.3	80.2	92.5	104.0
Consumption	9.9	10.4	12.0	13.5

Industrial Water One of the nation's most important concentrations of heavy industry is located along the Lake Michigan shoreline of Region One-A. These industries are dependent upon an essentially unlimited supply of water and access to the Great Lakes navigation system.

The amount of water withdrawn by industries in this region constitutes eighty-eight percent of all self-supplied industrial water withdrawn in Indiana. An estimated 3,125 mgd of water was withdrawn by Region One-A industries in 1977. Of the total industrial intake, 3,093 mgd is self-supplied from Lake Michigan. Approximately 32.0 mgd is purchased from public water utilities. Water supplied to industries from public water companies in Hammond, Whiting, Munster, Highland, Griffith, Gary, Hobart, Portage, and Burns Harbor is withdrawn from Lake Michigan. About 91.0 mgd is evaporated or otherwise consumed in the manufacturing process.

The largest water-using industry group is primary metals. Bethlehem Steel, Inland Steel, Midwest Steel, U.S. Steel, and the Youngstown Sheet and Tube Company are located on the shoreline of Lake Michigan. These industries support, and in turn are supported by, a host of smaller ancillary industries. The primary metals industry utilizes approximately 2,874 mgd.

The second largest water-using industry group is petroleum and refinery. This industry group uses less than ten percent of the water used by the primary metals group. Other industry groups using significant quantities of water are quarrying operations and manufacturers of chemicals, machinery, transportation equipment, and paper products.

Accurate projections of the future industrial water use in Region One-A are dependent upon the steel in-

dustry, which itself is influenced by the demand for steel, new technical processes, foreign competition, ore availability from western Lake Superior, and future environmental regulations. The projections assume that these factors will remain constant and no radical shifts in operating techniques will occur.

Industrial production by the year 2000 is expected to increase sixty-three percent above the 1977 value (United States Water Resources Council). Although industrial output is expected to increase, total industrial water intake is expected to decrease initially due to plant efficiency and then rise slowly as output increases. The current and projected self-supplied withdrawals and rates of consumption for industries located in Region One-A are presented in the following table.

Table 34

The 1977 and projected self-supplied withdrawal and consumption rates for industries in million-gallons-per-day.

<i>Industrial Self-Supply</i>	<i>1977</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>
Withdrawal	3,093.0	2,920.0	2,928.0	3,010.0
Consumption	89.7	92.2	117.2	145.8

Rural Self-Supplied Water The majority of rural self-supplied water is withdrawn from ground-water sources. An estimated 73,300 persons lived in homes supplied by individual wells in 1975. It is estimated that residential use of water approached 4.2 mgd in 1975. An estimated 6,500 additional persons may depend on their own wells for household water in the region by the year 2000. The withdrawal of rural self-supplied residential water may increase to approximately 5.8 mgd by the year 2000.

In 1975 an estimated 56,400 head of livestock and 106,000 chickens were located within the region. Collectively, these animals consumed approximately 0.5 mgd. Water withdrawals for livestock and chickens may increase slightly to 0.54 mgd by the year 2000.

The total withdrawal of rural self-supplied water may increase from the current 4.8 mgd to approximately 6.3 mgd by the year 2000, as presented below.

Table 35

The 1977 and projected water withdrawal and consumption rates for rural self-supplied water, in million-gallons-per-day.

<i>Rural Self-Supply</i>	<i>1977</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>
Withdrawal	4.8	5.0	5.7	6.3
Consumption	4.8	5.0	5.7	6.3

Irrigation Water The soil associations with irrigation potential as shown in Figure 58 are located mainly in the north among the dune and old beach ridges

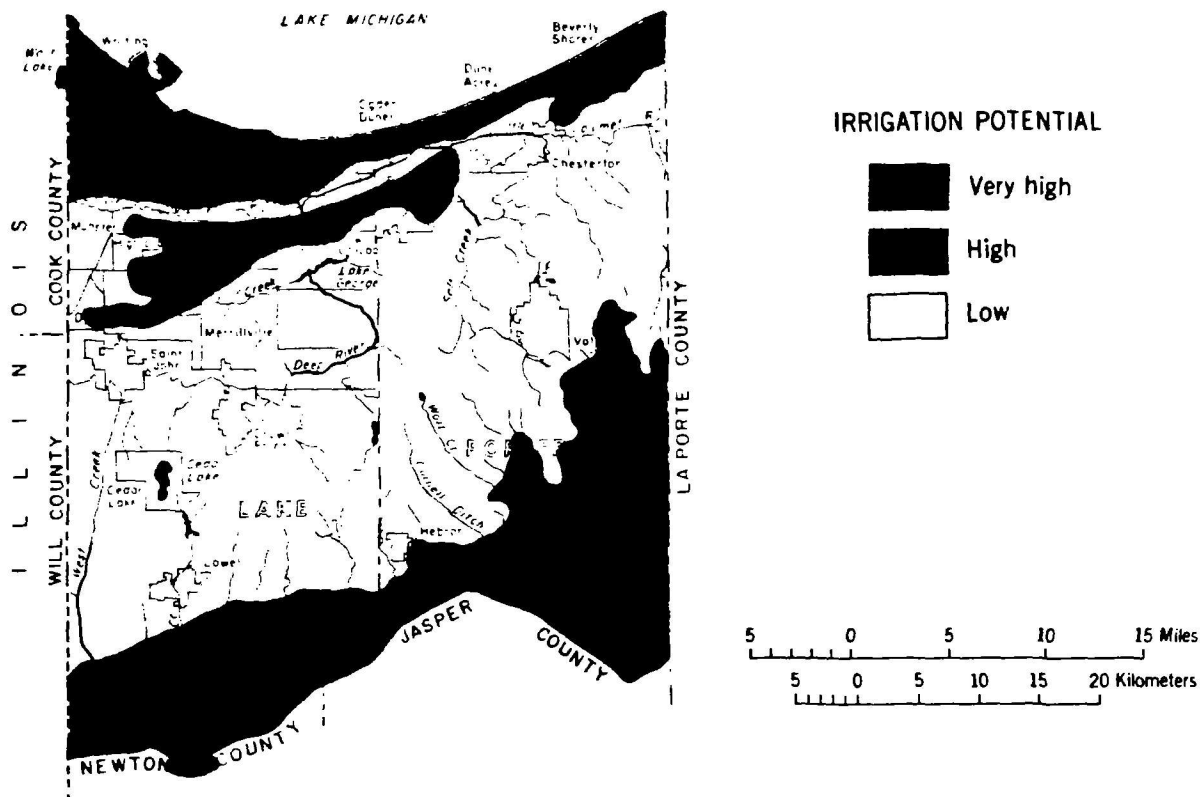


Figure 58
Map of Region One-A showing the general location of the soil associations that appear to possess an economic potential for the irrigation of croplands.

along Lake Michigan and in the south in the outwash plain and dunes of the Kankakee valley. Poorly drained soils are found in the Kankakee valley where irrigation is through water table control or subirrigation.

Based upon the survey of irrigated croplands, approximately 2,000 acres were irrigated in the region in 1977: 1,200 acres in Lake County, and 800 acres in Porter County. The principal crops irrigated were vegetables and corn.

Assuming 1977 as a normal growing year, these crops would have required about 5.4 mgd during the peak irrigation period of July and August.

It is estimated that about 40,000 acres of croplands could be profitably irrigated. Approximately 5,500 acres of croplands may be irrigated by the year 2000. Almost all of this additional irrigated acreage will be in the Kankakee valley. The expansion of irrigation acreage is expected to increase the peak July–August irrigation demand in an “average” season to 14.7 mgd. The “average” season increase in ground-water withdrawal for irrigation is expected to increase from the current 0.7 to 3.7 mgd by the year 2000.

In addition to the irrigation for agricultural use, there are about 655 acres of irrigated fairways and greens on the region's golf courses. About 2.0 mgd is applied to these areas during the peak July–August irrigation period.

The total withdrawal for irrigation of croplands and golf courses during the “average” irrigation season of 1977 was approximately 7.4 mgd. These withdrawals may increase to 18.0 mgd during the “average” growing season by the year 2000, as presented here.

Table 36

The 1977 and projected withdrawal of irrigation water for croplands and golf courses during the average growing season, in million-gallons-per-day

<i>Irrigation</i>	<i>1977</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>
Withdrawal	7.4	9.5	13.7	18.0
Consumption	7.4	9.5	13.7	18.0

Electric Energy There are three electric generating stations all located on Lake Michigan. The three existing stations are the State Line Generating Station, the Dean H. Mitchell Generating Station, and the Bailly Generating Station. The State Line plant is owned by the Consolidated Edison Company which exports all power generated by this facility to Illinois. Mitchell and Bailly are owned and operated by the Northern Indiana Public Service Company which serves northwest Indiana.

The State Line plant is rated at 968 megawatts (mw), the Mitchell Station is rated at 581.6 mw, and the Bailly

Station is rated at 649.5 mw. Intake requirements are 750 mgd for State Line, 398 mgd for Mitchell, and 341 mgd for Bailly.

The Northern Indiana Public Service Company is in the process of enlarging its generating capacity by adding a nuclear-powered generating unit to the Bailly Generating Station. The new unit, now under construction, is rated at 685 mw. The new unit will use a closed cycle cooling system. The addition of the Bailly unit will increase the intake requirements to 353 mgd. About 9.2 mgd will be lost through evaporation.

Water withdrawals for the production of electricity during 1977 were approximately 1,489 mgd. Water withdrawals are expected to decrease to 432 mgd by the year 2000 as presented below.

Table 37

The 1977 and projected water withdrawal and consumption rates for the production of energy, in million-gallons-per-day

<i>Energy</i>	<i>1977</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>
Withdrawal	1,489.0	1,501.0	1,501.0	432.0
Consumption	6.0	11.8	11.8	9.4

EXCESS WATER

Flooding

Approximately 24,600 acres of the region are subject to flooding. The major flood plains are shown in Figure 59. The average annual damages due to flooding were estimated in 1977 to be \$19.3 million, of which some ninety-two percent occurred in urban areas. Most of the urban damage occurs along the Little Calumet River in Lake County. This flooding problem has long been considered by the Department of Natural Resources to be the most serious urban flooding problem in Indiana. Figure 60 shows the estimated average annual flood damages in Region One-A.

Virtually all of the streams are subject to flooding. Flash flooding on streams in the area is uncommon due to the flat topography. The Kankakee, Little Calumet, and Grand Calumet Rivers are subject to slow rates of rise and long flood durations.

Flood Control Partial flood protection along the Kankakee River is provided by levees (spoil banks) that were constructed from dredge spoil. The levees are of variable top elevation and exhibit little uniformity in cross section. The levees along the Kankakee River in southern Lake County, coupled with the Singleton Ditch drainage system, kept Kankakee River

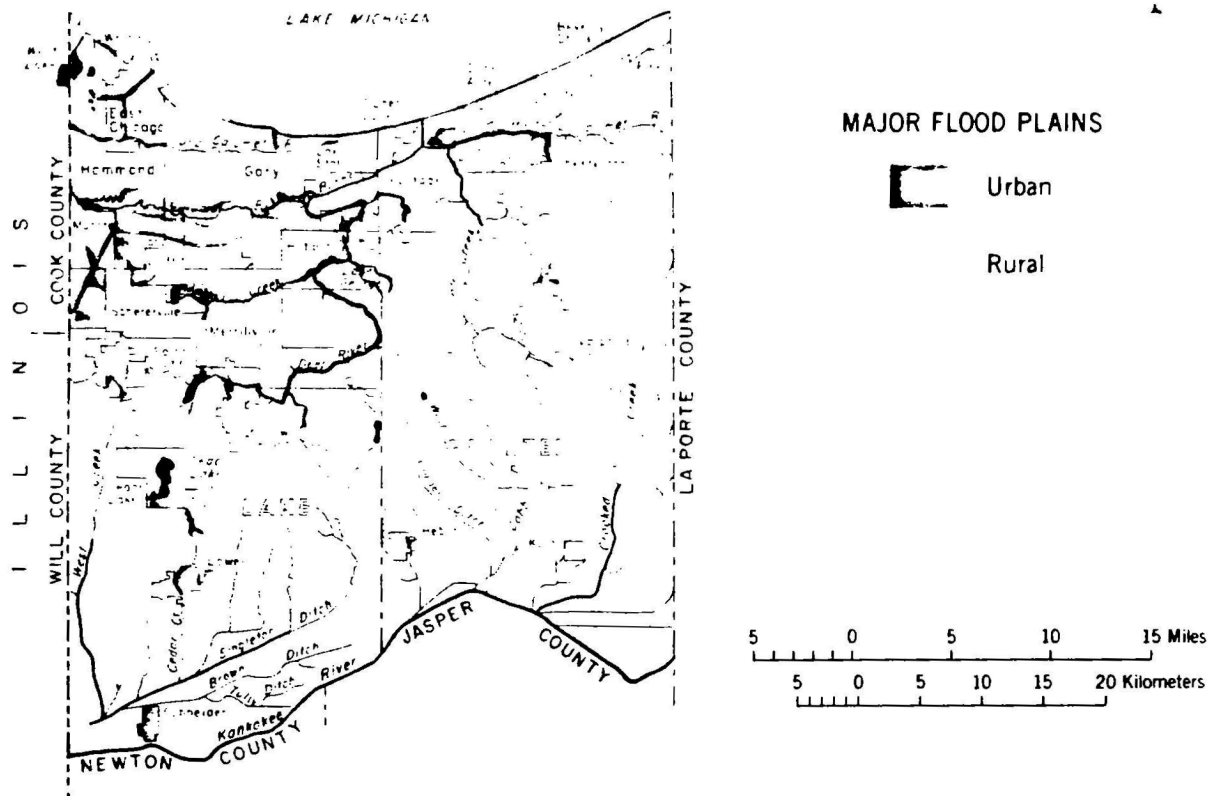


Figure 59
Map of Region One-A showing the major flood plains.

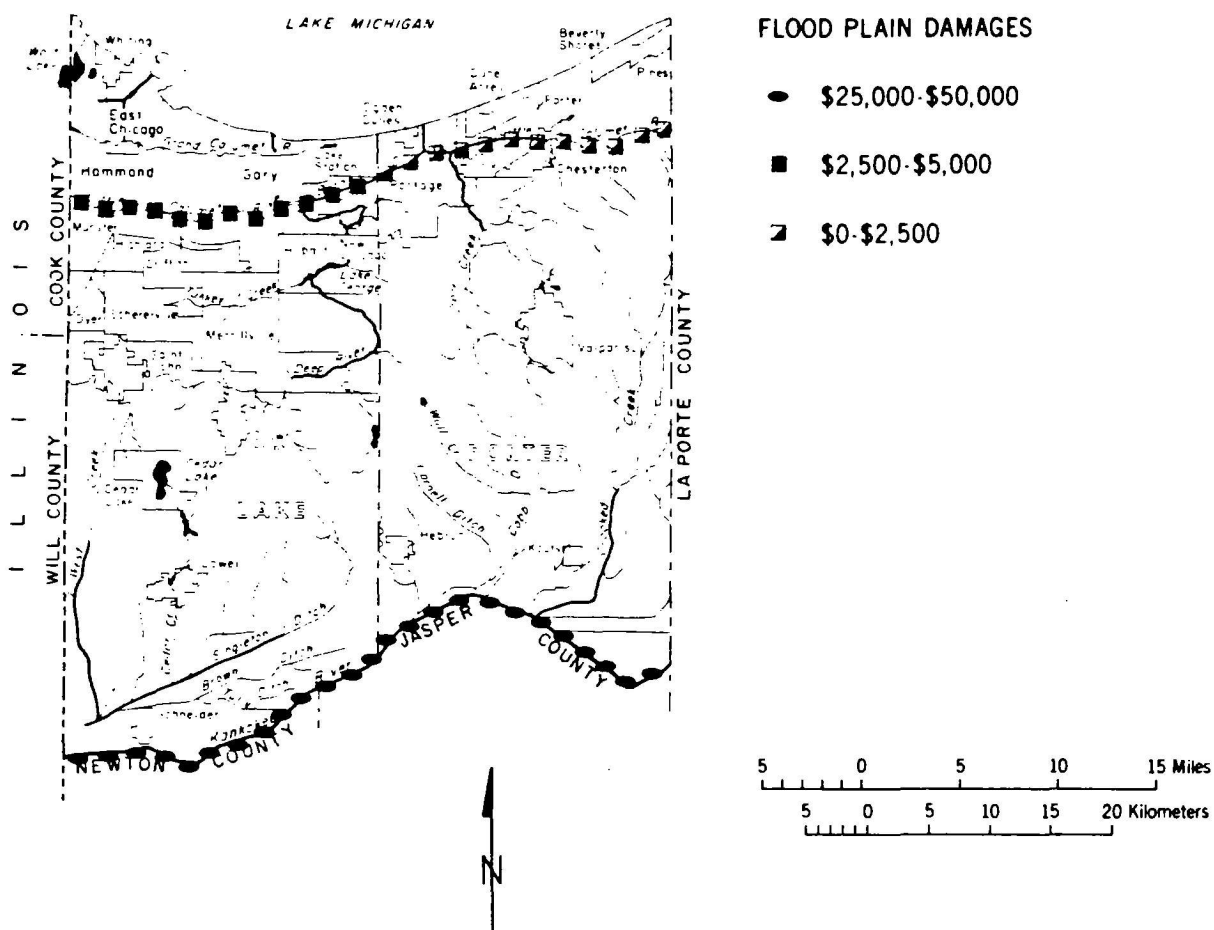


Figure 60
Map of Region One-A showing the estimated average annual flood damages per mile along selected streams.

floodwaters out of southern Lake County for many years. Very little maintenance has been performed and the degree of protection varies with the condition of the levee. The major flood damages in this watershed are agricultural in nature.

The major flooding problem on the Little Calumet River occurs in the highly urbanized area located between the Indiana-Illinois state line and Deep River. Large areas of the flood plain have been developed for residential and commercial purposes. Over 9,000 residences and commercial buildings have been constructed in areas that are subject to flooding.

The Grand Calumet River, a minor system in the region, drains a narrow strip of flat areas and beach ridges along Lake Michigan. Flooding along the Grand Calumet River is influenced by high stages on Lake Michigan.

The Chicago District, United States Army Corps of Engineers, is currently doing advanced engineering and design work on the proposed Little Calumet River project. This project consists of twenty-three miles of work on the West Arm of the Little Calumet River, Burns Ditch, and Burns Waterway to provide a safe outlet for floodwaters. Associated with the flood control facilities will be recreational facilities and a marina providing access to Lake Michigan.

The Kankakee River Basin Commission was formed in 1977 to study the problems of the Kankakee River. The basin commission has adopted a plan of channel work, levees, floodplain zoning, and land treatment, which protects, enhances, and maintains the wildlife and fisheries habitat and provides for land and water based recreation.

The Porter County-Kankakee River subarea is the only small watershed project, authorized for planning, located within the region.

Flood Plain Management All of the political jurisdictions in the region are participating in the emergency phase of the National Flood Insurance Program. Griffith, Highland, and Beverly Shores are participating in the regular National Flood Insurance Program. Residents of the areas can purchase insurance against property losses due to flooding.

Agricultural Drainage

Approximately thirty-six percent of the soil associations have "severe" wetness characteristics, fifty-nine percent have "moderate" wetness characteristics, while five percent have "slight" wetness characteristics. The general location of the soil associations with these wetness characteristics are shown in Figure 61.

Extensive investments in private and public surface and subsurface drainage systems have been made to overcome the high water table. There are 1,600 miles of legal drains in the two-county region. In much of the agricultural rural area paralleling the Kankakee River, lift pump drainage systems have been installed to carry water from the drainage system catch basin up and over river levees. Water table control, by regulating the water level in the drainage ditches, is also practiced. The complex drainage networks are dependent on the size and maintenance of the river and stream outlet system.

The urban areas of the region experience the drainage problems typical to most urban areas in Indiana. These include undersized drainage systems which lack capacity to handle the runoff from storms of any significant magnitude; combined storm water and sanitary sewer systems which contribute heavily to treatment plant bypassing and consequent stream pollution; and inadequate maintenance, primarily from lack of adequate local funding.

Soil Erosion

The erosion potential of soil associations within Region One-A is shown in Figure 62. Forty-four percent of the 601,000 acres is rated as having a "medium" soil erosion hazard. This land area lies in a belt across the central portion of the region. The remaining fifty-six percent of the land is predominantly level and ranks as having a "low" erosion potential.

WATER QUALITY

The surface streams routinely surveyed for water quality in 1978 by the Indiana State Board of Health were the Grand Calumet River, Little Calumet River, Burns Ditch and Waterway, Salt Creek, Indiana Harbor Ship Canal, and the Kankakee River. In addition, Lake Michigan and Wolf Lake were surveyed. Water quality standards for the region were established by the Stream Pollution Control Board regulations SPC 1R-4 (Water Quality Standards for the State of Indiana), SPC 4R-2 (Water Quality Standards for Lake Michigan and Contiguous Harbor Areas, 1978), SPC 7R-3 (Water Quality Standards for the Grand Calumet River and the Indiana Harbor Ship Canal, 1978), SPC 10R-2 (Water Quality Standards for Wolf Lake, 1978) and SPC 12R (Natural Spawning, Rearing, and Imprinting Areas, 1978).

The dissolved oxygen concentration at the Gary water intake on Lake Michigan has ranged above the minimum standard. In addition, the concentration of total coliform bacteria was within the standards for raw drinking water. The fecal coliform bacterial level

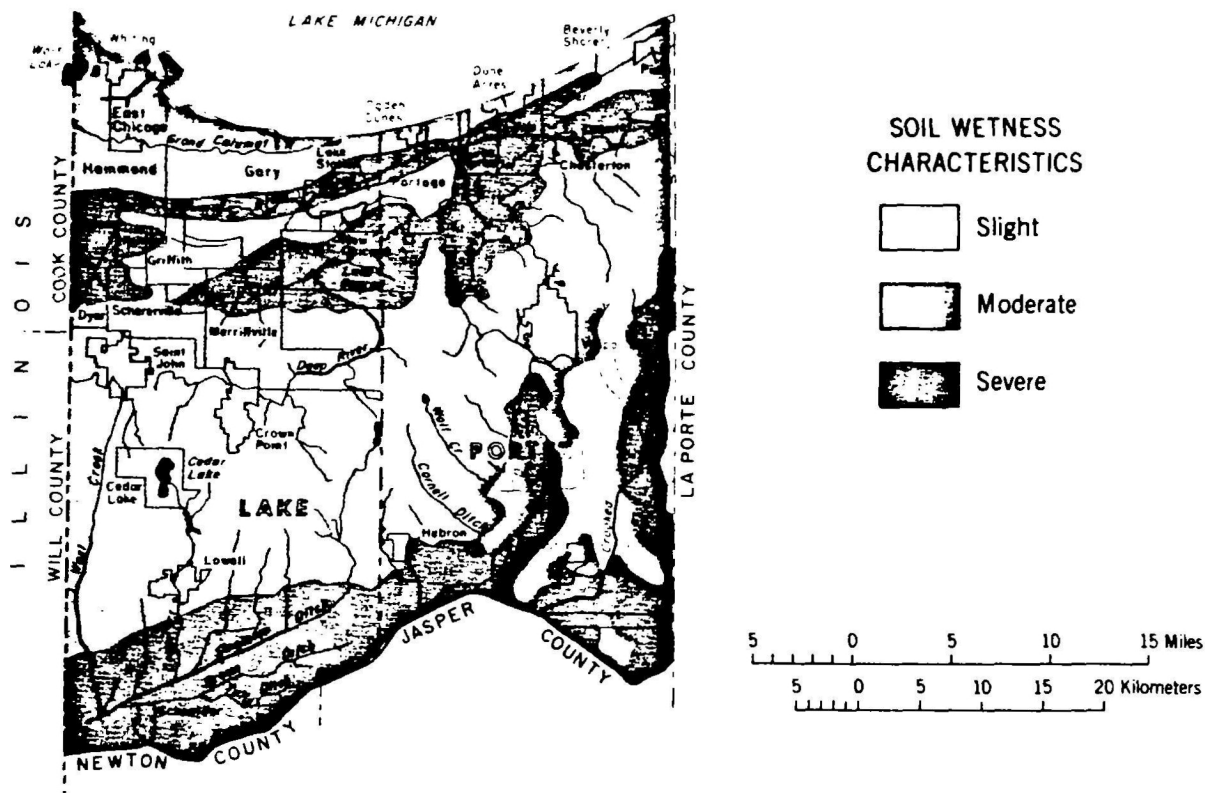


Figure 61
Map of Region One-A showing the general location of the wetness characteristics of soil associations.

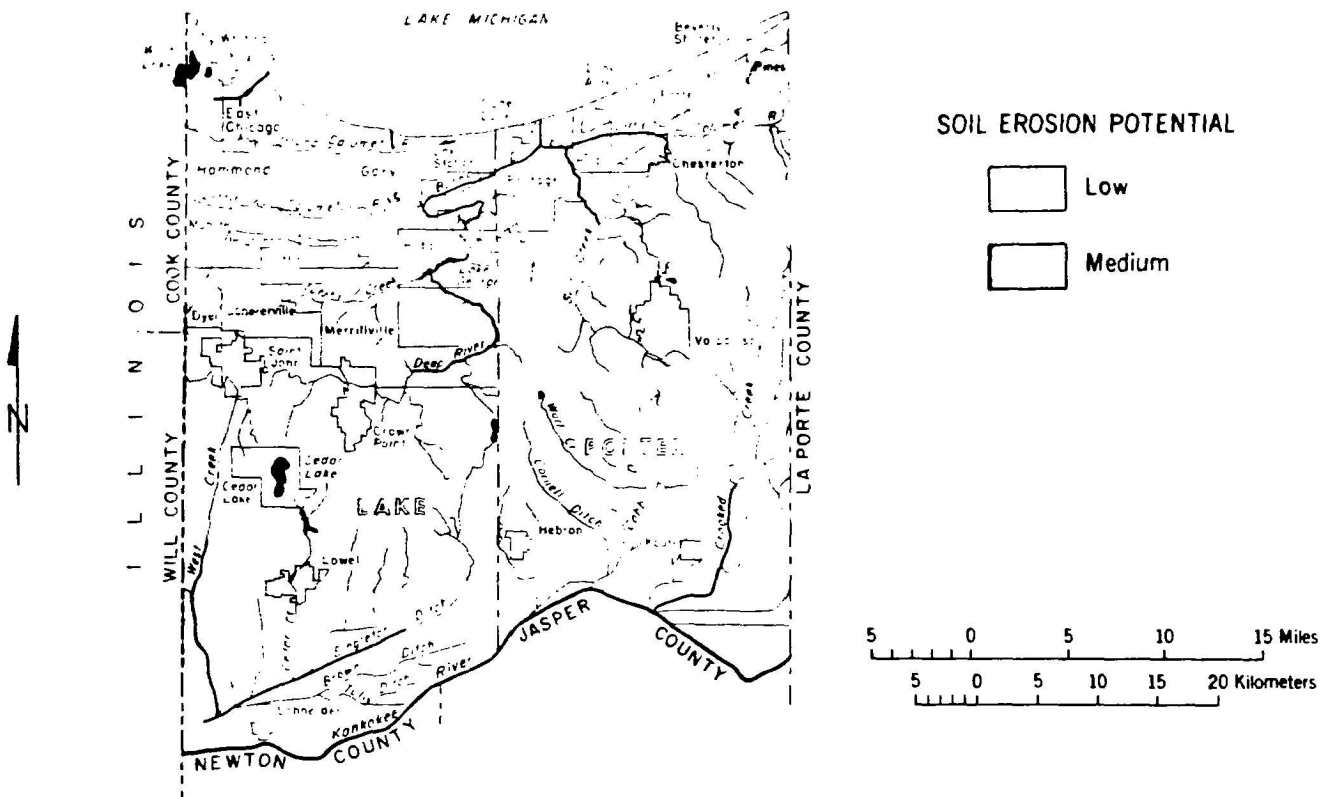


Figure 62
Map of Region One-A showing the erosion potential of the soil associations under fallow land conditions.

at various sampling points in Lake Michigan was not exceeded from April through October, when whole-body contact recreation was allowed. The pH, a measure of the acidity or alkalinity of a substance, of the water at the Gary intake generally remained within the recommended range as established by SPC 4R-2.

The Grand Calumet River consists almost entirely of both treated wastewater and wastewater of nonpoint source origin. The unnatural character of the stream indicates that even when all wastewater discharges are provided with best available treatment technology, the Calumet River may not be capable of sustaining a diverse fishery. The Grand Calumet River is classified as waters for partial body contact and limited aquatic life.

In this region, the Grand Calumet River experiences temperature violations, usually occurring during the months of October and November. The dissolved oxygen content at the Indiana-Illinois state line has violated the standard established by SPC 7R-3 approximately fifty percent of the time. Most of the dissolved oxygen violations occurred during the summer. One contributing factor to the low oxygen levels is the uptake of oxygen by bacteria decomposing the large amount of organic material discharged into the Grand Calumet by natural runoff, stormwater from sewers, and discharge from municipal and industrial treatment plants.

Other parameters evaluated for the Grand Calumet River include nitrate, pH, and biochemical oxygen demand: a measure of the amount of oxygen consumed in the biological processes that breakdown organic matter in water. Nitrate levels of the Calumet River fell within acceptable levels. Water quality samples collected in Gary indicated the biochemical oxygen demand was at an acceptable level. However, the biochemical oxygen demand levels that occurred at the Indiana-Illinois state line were higher than desirable. The pH values of the Grand Calumet River fell within the recommended range at both stations.

The Grand Calumet River is designated for partial body contact recreation. The levels of fecal coliform bacteria appear to exceed the criteria for partial body contact at the Indiana and Illinois state line. This violation could possibly be associated with chronic chlorination problems at the Gary wastewater treatment facility.

No temperature violations were recorded for the Indiana Harbor Ship Canal, but dissolved oxygen values were often not in compliance with the standards. In the canal, both nitrates and the biochemical oxygen demand were usually at acceptable levels and maximum and minimum pH values were found to be within standards.

Portions of the Little Calumet River and Burns Ditch are designated for partial body contact recreation and

are capable of supporting a cold water fishery. Data for the Little Calumet River and Burns Ditch did not indicate temperature violations, although temperatures taken at Hohman Avenue Bridge in Hammond and State Road 149 northwest of Porter indicated the presence of thermal inputs between the two stations.

In the upper reaches of the Little Calumet River, a cold-water fishery migration route, the concentration of dissolved oxygen met the standard. The dissolved oxygen concentration in the reaches near Hammond usually met the water quality standard for warmwater fish. Most dissolved oxygen violations occurred in late summer and early autumn. Data indicates that nitrate and pH levels were generally within the recommended levels, but the biochemical oxygen demand often exceeded its levels, especially during the fall.

The Little Calumet River is designated for partial body contact recreation at the station at State Road 149 northwest of Porter. However, this standard was not met during summer and fall months. The station downstream at the Hohman Avenue Bridge in Hammond could not meet this standard except during June and August.

One of the streams that augments the Little Calumet River is Burns Ditch. Data for Burns Ditch indicated that temperature, dissolved oxygen, biochemical oxygen demand, nitrate, and pH levels were acceptable year-round. Designated for partial body contact recreation, the fecal coliform bacterial levels in Burns Ditch occasionally exceeded the standards.

Salt Creek, which also augments the Little Calumet River, has twelve wastewater dischargers, the largest of which is the city of Valparaiso. The standard for dissolved oxygen was met above the Valparaiso treatment plant but dropped below the standard downstream from the plant. Similarly, the biochemical oxygen demand met the recommended level upstream of Valparaiso but exceeded the recommended level downstream from the treatment plant. The number of fecal coliform bacteria exceeded the standard downstream of Valparaiso. It is anticipated that once Valparaiso completes its additional ammonia-nitrogen and disinfection facilities, instream standards will be achieved.

Temperature, dissolved oxygen, and nitrate levels for the Kankakee River were acceptable. The biochemical oxygen demand seldom exceeded the standard.

Regulation SPC 10R-2 (Water Quality Standards for Wolf Lake, 1978) designates Wolf Lake to be maintained not only for full body contact recreation but also for a warmwater fishery. Temperature, dissolved oxygen, and fecal coliform bacterial levels were within the state standards. Some monthly pH maximums have exceeded the limit for Wolf Lake.

The trophic or age classification of those lakes surveyed by the Stream Pollution Control Board in Region One-A follow.

Table 38
Trophic classification of lakes surveyed.

<i>Lake</i>	<i>County</i>	<i>Age Classification</i>
Clear	Porter	I
Flint	Porter	I
Morgan	Porter	II
Sagars	Porter	II
Wahab	Porter	II
Long	Porter	II
Billington	Porter	II
Canada	Porter	II
Spectacle	Porter	II
Fancher	Lake	II
Eliza	Porter	II
Mink	Porter	II
Dale Carlia	Lake	III
Lake George (Hammond)	Lake	III
Lake George (Hobart)	Lake	III
Loomis	Porter	III
Wolf Lake	Lake	III
Cedar	Lake	III